# EXHIBIT 3

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HONORABLE JOHN C. COUGHENOUR

UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF WASHINGTON

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| WASHINGTON TOXICS COALITION, NORTHWEST COALITION FOR ALTERNATIVES TO PESTICIDES, PACIFIC COAST FEDERATION OF FISHERMEN'S ASSOCIATIONS, and INSTITUTE FOR FISHERIES RESOURCES,<br><br>Plaintiffs,<br><br>v.<br><br>ENVIRONMENTAL PROTECTION AGENCY, and CHRISTINE TODD WHITMAN, ADMINISTRATOR,<br><br>Defendants,<br><br>AMERICAN CROP PROTECTION ASSOCIATION, et al.,<br><br>Intervenor-Defendants. | Civ. No. C01-0132C<br><br>DECLARATION OF D. KEN GILES, PH.D. |

I, D. Ken Giles, Ph.D, hereby declare and state as follows:

BACKGROUND AND CREDENTIALS

1. I am a Professor in the Biological and Agricultural Engineering Department at the University of California, Davis and have served in that position since 1987. From 1997 through

2001, I served as chair of the Plant Protection and Pest Management Graduate Group. I teach courses in engineering research, engineering design, and applied pest control practices, particularly pesticide application technology. I currently direct a research program including a number of full time Ph.D. staff researchers, graduate students, undergraduate students and international scholars. This research program is focused on pesticide application technology, automation of field operations and dispensing systems for industrial and consumer spray products. My full curriculum vita is attached as Exhibit 1.

2. I have B.S. and M.S. degrees in Agricultural Engineering from the University of Georgia, and a Ph.D. in Engineering from Clemson University. I have received numerous awards for my academic work, including Engineering Concept of the Year from the American Society of Agricultural Engineers (1999), Outstanding Paper of the Year Award from the American Society of Agricultural Engineers for multiple years, and the AE-50 Award for Outstanding Product in Agricultural Engineering from the American Society of Agricultural Engineers (1998).

3. My research focuses on designing, developing, and evaluating agricultural pest control systems; on control systems for spray chemical delivery devices; and on automation of agricultural practices using Global Positioning System navigation. In addition to research papers, my research has resulted in several patents and patents-pending for spray control devices. Understanding spray drift is crucial to my research work on spray chemical delivery systems. I spent 1999 working in Europe under a cooperative program and on projects involving government agencies and spray equipment manufacturers. I worked at the Danish Institute for Agricultural Sciences, Hardi International A/S and the German BBA lab in Braunschweig, Germany. During that time, I became very familiar with European and British test standards,



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equipment approval procedures and drift management regulations.

4. I was an independent, outside reviewer for the U.S. EPA review of spray drift studies submitted by the Spray Drift Task Force (a consortium of agrochemical companies that conducted drift experiments). In that regard, I conducted a detailed review of the study reports, data and analyses of the ground-based field spray and air-blast spray tests conducted by the Spray Drift Task Force. Through that review, I became extremely familiar with the approach, methods, data, analyses and limitations of the studies. Since that time, I have attended numerous professional meetings, industrial outreach events and other conferences where representatives of the Spray Drift Task Force have presented various forms of the test results.

## FRAMEWORK OF THIS DECLARATION

5. The plaintiffs have retained me to provide technical information to the court about spray drift from pesticide applications. I have agreed to respond to questions plaintiffs have submitted seeking specific technical information on matters that lie within my areas of expertise. These areas of expertise cover the basic mechanisms through which pesticide droplets are released from application equipment, deposit on target surfaces and travel to non-target areas. Additionally, my areas of expertise extend into the basic principles of optimizing pesticide application through improving efficacious deposit so that use rates of pesticide can be reduced and the design and deployment of specific drift mitigation equipment and practices.

6. My expertise does not extend into pesticide chemistry, environmental toxicology, meteorology or public policy. I am an advocate only for regulatory decisions based on rational, quantitative science, not for particular positions. I have answered the following technical questions based on my training, experience and research and on my familiarity of the current body of knowledge in peer-reviewed technical journals.

7. In particular, the plaintiffs have asked me to address the use of buffer zones as a


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means to mitigate surface deposition of agricultural sprays onto waterways and other sensitive areas with respect to the exposure of aquatic organisms to pesticides.

DESCRIBE THE PHENOMENA OF SPRAY DRIFT FROM PESTICIDE APPLICATIONS.

8. The EPA defines pesticide spray drift as "the physical movement of a pesticide through air at the time of application or soon thereafter, to any site other than that intended for application (often referred to as off-target)." Source: EPA fact sheet, Spray Drift of Pesticides, http://www.epa.gov/pesticides/citizens/spraydrift.htm.

9. A more comprehensive definition of spray drift would include the physical movement of pesticide droplets, particles, or gas-phase chemicals away from the application site both during and after a pesticide application. Under the more comprehensive definition, drift includes not only spray droplets created during a pesticide application, but also particles and droplets that volatize after application. The second definition captures "secondary drift" or the volatilization of agrochemicals from plant and soil surfaces, which also pose a hazard to nearby off-target receptors.

10. The mechanisms that produce spray drift have been researched and are functionally understood. Drift begins with pesticide droplets that are released in such a manner so that they have a low probability of being deposited on target surfaces. Some conditions that lead to a low likelihood of deposition are insufficient kinetic energy for transport and impaction and long travel time between the point of droplet release and the target due to excessive distance between point of droplet release or low droplet velocity. Droplets that are not deposited in the target area soon after release form the portion of the spray that is available as a mass source for displacement to non-target areas. Droplets that are available for drift are displaced to non-target areas primarily through ambient air movement. This ambient movement can be due to natural wind, thermal currents or, in some cases, air displacement from the spray vehicle – ground or



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aerial. The layman's term for this non-target deposition is "spray drift". Technically, spray drift is a consequence of two events occurring simultaneously: 1) the production and release of droplets with drift potential and, 2) the occurrence of environmental conditions that displace the droplets from the target area to a sensitive non-target area.

11. Because the process of spray drift is related to the characteristics of the spray and the transport of the drift fraction, the occurrence and severity of spray drift is influenced by both the mechanical factors of the application method and equipment and the environmental conditions. Influential mechanical factors include the concentration of pesticide in the applied liquid, physical properties of the spray liquid, the droplet size spectrum, the velocity of the droplets, use of supplemental carriers such as air jets or electrostatic forces, mechanical shields, vehicle ground speed, proximity of the nozzle to the target foliage and density and structure of the target foliage. Influential environmental factors include wind speed, direction, turbulence, atmospheric stability, topography and surface conditions of the landscape and relative humidity. The quantity of applied pesticide that ultimately travels from the nozzle to a specific non-target site is affected by all the above factors along with the distance from the nozzle to the non-target site.

12. At any point downwind from an application site, the spray drift consists of two components, those droplets that are "falling out" of the ambient air and depositing on the ground or similar surfaces and those droplets that continue to move downwind while remaining suspended in the ambient air. For exposure to aquatic organisms, the fallout fraction is of primary concern because it directly enters the surface water. The airborne fraction can present a respiratory exposure hazard to terrestrial organisms, including humans. The fallout fraction is commonly measured by passive dosimeters, artificial targets or bioassay organisms; this



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deposition is most commonly reported in drift studies. The airborne fraction is accurately measured only by iso-kinetic sampling methods.

DESCRIBE THE EFFICACY OF NO SPRAY BUFFERS IN MINIMIZING SPRAY DRIFT.

13. By a strict definition, the presence of buffer zones (non-sprayed areas between the sprayed target area and the sensitive non-target area) does not reduce spray drift in that it does not alter the environmental conditions or the mechanical factors of the application. However, a buffer zone provides a displacement between the application site and the sensitive area. Within this displacement, the fallout portion of the spray drift steadily decreases. With a sufficiently wide buffer, the spray fallout can decrease to a level below that of a biologically significant level for the ecosystem and the organism of interest. Additionally, if the unsprayed buffer zone is within the field to be treated, it results in less total pesticide being applied to the site and correspondingly, less total pesticide loading in the environment.

14. The basic working principle of buffer zones for spray drift mitigation is derived from the characteristic curves showing the relative fallout (calculated as a proportion of the application rate of pesticide in the treated field) as a function of downwind distance from the edge of the treated area. These characteristic curves appear in virtually all technical reports addressing drift, including materials prepared by the pesticide industry's Spray Drift Task Force and the U.S. EPA.

15. A characteristic of these drift curves is their non-linear nature in that the greatest benefit (defined as increased reduction in fallout per unit increase in buffer zone length) occurs nearest the edge of the application and decreases with distance. So, for example, small increases in width near the field edge provide much more relative benefit than even large increases in already wide buffer zones.

16. Deposition curves can be produced by either field studies where fallout and



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airborne drift are measured following a test application or they can be developed from mathematical models where the spray release and atmospheric transport processes are represented by the fundamental equations of motion for suspended droplets. These models can vary widely in complexity and account for surface conditions, evaporation, turbulence and factors to varying degrees. In some cases, such as EPA's ground and airblast drift models, the foundation is approximation based on field data instead of solution of the basic principles. All models are limited by the basic assumptions used in their creation and extrapolation of field results must be done with great caution since only a limited number of parameters are varied in the experimental design. A study done with one particular spray application system may not represent the characteristics of any other application system. Nonetheless, a wide collection of field studies and use of numerous models can provide insight into the basic nature of spray drift behavior.

17. Studies with bioassays (Marrs, et al., 1993) have suggested 20 m (21.7 yds) as a "reasonable" buffer zone to prevent phytotoxicity of non-target plants to applied herbicides. Studies in the Netherlands have generally concluded that for field spray applications, buffer zones on the order of 2-6 m (2.2 – 6.5 m) are effective at reducing drift in waterways to approximately 1% or less of the deposition rate in the target areas. (De Snoo and de Wit, 1996). A parametric study using random-walk models and then verified with field tests (Holterman et al., 1997) concluded that a 10 m (10.8 yds) buffer resulted in reduction in drift down to < 1% of the applied rate. Indication that buffer zones provide environmental benefits is supported by the Dutch studies that found that diversity of flora and fauna in unsprayed buffers increased over a four year period of no spraying (de Snoo, 1997; de Snoo, 1999).

18. In the U.S., the agrochemical industry and private contractors conducted some



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field studies to determine typical drift characteristics. From these studies of ground-based applications, calculations to interpolate or extrapolate have been used by U.S. EPA and other organizations for educational purposes and basic risk assessment. Aerial application models have been developed using field data and basic computations with origins in early work by the U.S. Forest Service in the 1970's – 80's. Generally, the U.S. studies have not considered the beneficial effects of windbreaks and other vegetation within the buffer zone. Most studies have used fallow land for the test conditions; therefore, they would be conservative in that they would overestimate the drift downwind.

19. A study by Bird, et al. (1996), found that deposits of spray drift from aerial applications decrease dramatically over distance. At 30 meters downwind from application, researchers found about 5% of the normal application rate of pesticide was detected as drift, while at 150 meters, 0.5% of the normal application rate of pesticide was found. The greatest decline in off-target deposit rates occurred between 0 and 100 meters (100 meters is 108 yds); greater distances showed only slight reductions in pesticide drift.

20. The Spray Drift Task Force developed a model that projected that drift, as a fraction of applied chemical discovered at off-target sites, declined with distance. Teske, et al. (2002). Other research confirmed the AgDRIFT model in real-world tests at distances up to 100 meters. Bird, et al. (2002).

21. A parametric, mathematical study by Craig, et al. (1998) used a Gaussian Diffusion Model to determine spray drift from aerial applications. The study provided insight into the sensitivity of drift characteristics to changes in droplet size spectra, ambient wind speed, turbulence intensity and spray release height. For a typical spray condition a 100 m (108 yd) buffer produced spray fallout of 0.5 % of the application rate. An additional 100 m (108 yd)



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increase in the buffer zone reduced drift to 0.1% of the application rate. In contrast, a 50 m (54 yd) buffer reduced spray fallout to 5.0% of the application rate.

22. It must be recognized that buffer zones provide a <u>relative</u> decrease in fallout from the application site. Drift curves from models and composite field studies typically indicate the proportion of applied spray that deposits at a given location downwind. Adverse environmental effects stem from <u>absolute</u> values of the compound of concern. Therefore, rigorous, science-based risk assessment and reduction should be based on fundamental toxicology of the particular situation.

DESCRIBE THE EFFICACY OF A 100-YARD DIFFER FOR AERIAL APPLICATIONS AND A 20 YARD BUFFER FOR GROUND APPLICATIONS.

23. My response to the previous question included quantitative results from published, peer-reviewed studies. The 100 yd (92 m) and 20 yd (18.5 m) buffer zones for aerial and ground applications, respectively, should reduce deposition caused by fallout drift by 99% or more as compared to intentional deposition in the normally-sprayed field boundary. From information provided to me by the plaintiffs, I understand that a large number of the county bulletins developed to protect species from pesticides under the Endangered Species Act employ buffers of varying sizes to prevent migration of pesticides into threatened and endangered species' habitat. Some bulletins contain buffers as large as one half mile (880 yards) for aerial applications. Others employ a two-tier spray drift buffer with a 200-yard buffer for aerial applications and a 40-yard buffer for ground applications. Most of the bulletins use a 100-yard buffer for aerial spraying and a 20-yard buffer for ground applications.

24. Under some application conditions and techniques, detectable amounts of pesticides may still drift into surface waters even with these buffers. Under other application conditions and techniques, which seek to control the production of spray drift at its source in the



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first place, it may be possible to mitigate drift with buffers varying size. This is the premise of the Local Environment Risk Assessment for Pesticides (LERAP) system in the U.K. The development of buffer zones for protection of waterways is highly developed in Northern Europe and the U.K. (Note that aerial application is extremely rare in these areas so the effort is almost exclusively on ground-based application). Regulatory approaches based on buffer zones have been created using numerous published studies that quantified the efficacy of buffer zones. A prototypical example is the LERAP program in the U.K. (Pesticides Safety Directorate, www.pesticides.gov.uk). In that program, buffer zones are established around waterways. The width of the buffer zone is a function of the size of the waterway, the dose of pesticide being applied and the performance of the application equipment. Performance of the spray application equipment is determined through standardized testing conducted by government research laboratories. The applicator has the option of choosing the combination of pesticide dose, application equipment and buffer zone width in order to meet the desired level of drift mitigation. For particular chemicals, a default buffer zone is established. If the applicator reduces the amount of chemical applied or uses proven drift-reducing application technology, the buffer zone can be reduced. The LERAP system for orchard and vineyard airblast sprayers is more complex and involves accounting for vegetation and windbreaks between the application site and the sensitive area.

25. Similarly, coordination of spray operations with favorable weather conditions (wind direction and consistency) can provide protection of sensitive areas that exceeds that of buffer zones. However, these strategies require that the application have the appropriate information and techniques with which to make the proper decision and execute it. Buffer zones can provide a more easily managed and enforced mitigation strategy.



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26. Drift-reducing application technology often increases droplet size because, other things being equal, a larger, heavier pesticide droplet is less likely to be picked up and carried by air, and, therefore, is less likely to travel as far. The use of large droplets, however, can have negative side effects, such as requiring more pesticide to be applied than with a fine spray, and increasing the amount of pesticide that falls to the ground and migrates to streams in surface water runoff.

27. Weather conditions affect drift. While some buffer schemes depend on wind patterns, to be effective such schemes include wind speeds, directions, and measurements using specified equipment and prescribed measurement techniques. EPA's spray drift Pesticide Registration Notice 2001-X (www.epa.gov/oppmsd1/PR_Notices/prdraft-spraydrift801.htm) specifies the location, height, and equipment that must be used to measure wind speeds. The California interim measure bulletins have larger buffers (200 yards for aerial applications and 40 yards for ground applications) that apply when the wind is blowing toward the sensitive areas. It is widely accepted that aerial applications should not be made during stable conditions because a cloud of small droplets is often left suspended in air available for transport when winds are generated.

28. Long-term solutions that are tailored to particular pesticide applications involve a commitment of resources on the part of growers and pesticide users, as well as oversight and monitoring to ensure effective implementation and compliance with necessary safeguards. Where the goal is to minimize spray drift from pesticide applications during the period when such long-term solutions are developed, spray drift buffers offer an easily workable and effective mitigation.

Pursuant to 28 U.S.C. § 1746, I hereby declare under penalty of perjury that the foregoing



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is true and correct. Executed in Davis, California, on this 22nd day of November, 2002.

D. KEN GILES, PH.D.



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